VIBRATION SUPPRESSED VEHICLE MIRROR

The present invention relates to vehicle mounted mirrors, and in particular to vehicle rear vision mirrors mounted external to the vehicle cabin.

BACKGROUND

With any vehicle mirror, it is important to stabilise the position of the reflective mirror surface providing the rear view with respect to either the vehicle or with respect to the driver. Vibration causing rotational movement of the reflective mirror surface can present a moving or fuzzy rear view image to the vehicle driver. Sources of vibration include the vehicle's engine and small scale vertical vehicle movement caused by the road surface.

In order to provide rear vision to the side of a vehicle, many vehicles have mirrors mounted external to their cabin. Such mirrors either provide an alternative rear view to an internally mounted mirror or, in the case of many trucks, provide the only rear view.

Stabilisation of externally mounted mirrors is more difficult than stabilisation of internally mounted mirrors for a number of reasons. Externally mounted mirror housings are subject to additional forces (for example aerodynamic forces) and are often more complex in their design. For instance, external mirrors often require an ability to break away upon impact with a pedestrian and therefore have pivots and detent mechanisms between a vehicle body and the mirror surface. External mirrors often have motor drive systems for remote adjustment of their position and heating equipment to prevent fogging and/or icing. These additional systems add weight. Heavier mirror housings have greater inertia and therefore are more difficult to attach to the vehicle in a way that ensures they do not vibrate with respect to the vehicle. Generally heavier mirrors are supported by larger and stiffer cantilevered arms. This adds to the cost of the vehicle and can detract from the appearance of the vehicle.

It is an object of the present invention to provide a vehicle mirror assembly that stabilises a mirror reflective surface against tilting vibration and thereby overcomes at least some of the aforementioned problems.

SUMMARY OF THE INVENTION

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According to the invention there is provided a vehicle mirror assembly comprising:

a mirror frame;

a rotor rotatably mounted with respect to the mirror frame;

a means for rotating the rotor with respect to the mirror frame;

a connection means operably interposed between the rotor and the mirror frame allowing pivoting of the rotor with respect to the mirror frame; and

a mirror, having a reflective surface, mounted with respect to the rotor so that the surface remains substantially parallel to the plane in which the rotor rotates,

whereby the rotor stabilises the mirror against tilting vibrational movement.

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Preferably the connection means is arranged and constructed such that the angle of the mirror surface, with respect to the mirror frame, can be adjusted.

Preferably the vehicle mirror assembly comprises a support portion interposed between the mirror frame and the rotor, the support portion supporting the rotor.

The mirror may be mounted either to the support portion (and therefore non-rotatable) or may be mounted directly to the rotor.

Preferably the connection means comprises:

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a pivot mounting interposed between the mirror frame and the support portion; and

at least two legs operably interposed between the mirror frame and the support portion, each leg comprising an actuator for adjusting the no-load length of the leg and a vibration absorber connected in series to the actuator,

wherein the actuator enables adjustment of the timed-averaged orientation of the mirror with respect to the mirror frame and the vibration absorbers reduce the transmission of vibration forces from the mirror frame to the support portion.

The connection means, connecting the support portion (and hence rotor) to the mirror frame, ensures that the mirror will not follow high frequency tilting movements of the mirror frame. At the same time the connection means will ensure that the rotor stabilised mirror will generally remain in the same angular orientation with respect to the vehicle to which the mirror frame is attached.

Preferably the rotor is a substantially disc-shaped flywheel having a diameter of at least two thirds of the smallest bisector of the mirror surface.

According to a first aspect of the invention, the means for rotating the rotor is preferably air driven.

According to a second aspect of the invention, the means for rotating the rotor preferably comprises an electric motor.

The mirror frame preferably comprises a mirror case that substantially encapsulates the support portion, rotor and mirror from behind the mirror surface.

Specific embodiments of the invention will now be described in some further detail with reference to and as illustrated in the accompanying figures. These embodiments are illustrative, and are not meant to be restrictive of the scope of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Preferred embodiments of the invention are illustrated in the accompanying representations in which:

Fig 1 shows a rear view of the mirror assembly according to a first embodiment of the invention; and

Fig 2 shows a cross sectional view of the mirror assembly of Fig 1 through the plane 2-2 as indicated on Fig 1.

Fig 3 shows a rear view of a mirror assembly according to a second embodiment of the invention.

Fig 4 shows a cross section view of the mirror assembly of Fig 3 through the plane 4-4 as indicated on Fig 3.

Fig 5 shows a rear view of a mirror assembly according to a third embodiment of the invention.

Fig 6 shows a front perspective view of the mirror assembly of Fig 5.

Referring to Figs 1 and 2, a vehicle mirror assembly 10 is shown for mounting external to a vehicle. In this first embodiment of the invention the vehicle mirror assembly 10 comprises a support arm 12 for connection to a vehicle, a mirror frame in the form of a mirror case 14 and a rotor stabilised mirror 40. The rotor is in the form of a flywheel 34, although other rotor shapes could be used. A support portion 30 is provided to support the flywheel 34 and the mirror 40. A motor 32 is housed within the support portion 30. Motor 32 rotates flywheel 34 to create a gyroscope that has the effect of stabilising the mirror 40 and in particular preventing tilting vibrational movement being transmitted from the mirror frame (case) 14 to the mirror 40. This

arrangement allows support arm 12 to be relatively small and less stiff than would otherwise be required to prevent tilting vibration of the mirror 40.

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Interposed between the support portion 30 and the mirror case 14 is a connection means in the form of a pivot mounting 36 and two legs 20 and 60. Pivot mounting 36 allows pivoting of the flywheel and mirror with respect to the mirror case 14.

Pivoting of the mirror 40 with respect to the mirror case 14 is controlled by legs 20 and 60. Each of these legs includes an actuator 22 for adjusting the no-load length of the leg and a vibration absorber in the form of a spring 24 and a damper 26 connected in series to the actuator 22. The vibration absorbers reduce the transmission of vibration from the mirror case 14 to the support portion 30 (and therefore the mirror 40).

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The above-described connection means, connecting the support portion 30 (and hence flywheel 34) to the mirror frame (case) 14, ensures that the mirror 40 will not follow high frequency tilting movements of the mirror case 14. At the same time the connection means ensures that the flywheel stabilised mirror 40 will generally remain in the same angular orientation with respect to the vehicle to which the mirror case 14 is mounted. It also enables the rear view provided by the mirror 40 to be adjusted to suit the vehicle driver.

A second embodiment of the invention is shown in Figs 3 and 4. In this embodiment of the invention the mirror 40 is mounted directly to the flywheel 34 (rather than on the support portion 30). With this embodiment of the invention the mirror itself rotates. This arrangement has the advantage that water droplets are less likely to adhere to the mirror surface. In a variation of this embodiment, the flywheel 34 is eccentrically mounted so that its rotation causes lateral vibration. This lateral vibration further reduces the adhesion of water droplets to the mirror surface.

Fig 5 shows a third embodiment of the invention having two additional features. A second non-rotating and non-flywheel stabilised mirror 50 is provided. This mirror optionally may be a concave mirror for showing a wide rear view to the vehicle driver. Actuators may be positioned to ensure adjustment of the angle of mirror 50. The primary mirror 40 is mounted to a flywheel, as described in the second embodiment of the invention, and therefore is vibration stabilised and repels water from its surface.

Fig 6 is a rear perspective view of the third embodiment of the invention shown in Fig 5. In this third embodiment of the invention, the flywheel is air driven instead of motor driven. Air enters the mirror casing 14 through the entrance 17 of a duct 16 and then passes vanes 35 before exiting the mirror case 14 through its rear. This air movement imparts rotation to the flywheel. Various other air driven means for rotating the flywheel may be used.

Motor drive 32 may take various forms. For instance the motor's rotor itself may provide the rotational inertia required to produce the desired stabilisation.

Various types of rotors or flywheels may be employed to provide stability to the mirror based on the gyroscopic effect they produce.

While the present invention has been described in terms of preferred embodiments in order to facilitate better understanding of the invention, it should be appreciated that various modifications can be made without departing from the principles of the invention. Therefore the invention should be understood to include all such modifications within its scope.